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AUTHOR(S):

MITANI, Yohei; SUZUKI, Kohei; MORIYAMA, Kana; ITO, Nobuyuki

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Describing Local Community Characteristics in Japanese Rural Villages:
A community survey result and its application to explaining non-industrial private forest owners' behavior

Yohei MITANI, Kohei SUZUKI, Kana MORIYAMA, and Nobuyuki ITO

三谷羊平・鈴木康平・森山佳奈・伊藤伸幸 : 日本の農山村における地域コミュニティの実態調査：自治会長を対象とした調査結果と私有林所有者の行動を対象とした計量分析への応用

日本の農山村における高齢化と過疎化の進行は大きな問題となっている。日本の農山村地域には、規模の小さくつながりの強い地域コミュニティが多く存在してきた。そのような地域コミュニティの特性を把握することは、コミュニティにおける制度の役割を明らかにし、共有資源の集団的管理における住民間での協力維持への示唆を与える可能性がある。我々は愛媛県久万高原町において、自治会長を対象としたアンケート調査を実施した。本稿では、その調査結果を報告する。また、本調査によって得られたコミュニティ変数が、私有林所有者の集団管理施策への自発的な参加行動をどの程度説明しうるかを検証した。

1. Introduction

Japan has faced a long-term population decline. The population growth rate has been steadily decreasing over the past two decades and mostly below zero since 2006 (World Bank). A serious problem occurs in the rural areas of Japan, suffering aging and shrinking population. A long-lasting trend for younger generations to migrate to the urban/metropolitan areas has caused rural depopulation. Only older people remain in rural areas causing the median age to rise. In our study site, Kumakogen town, the population had dropped by 18.9 percent between 2000 and 2010 (Statistics Bureau Japan, 2000; 2010). The percentage of residents older than 65 years of age was 44.9 percent in 2010, which was 22 percent higher than the national average in the same year (Statistics Bureau Japan, 2010). As a result of rural depopulation, a non-negligible number of rural communities have been endangered and many more are expected to disappear in the near future (Rural Development Planning Commission, 2006).

We use a survey of over 100 community leaders in rural mountainous villages to document local community structure and characteristics. Understanding the structure of local community in rural villages might shed light on the role of community institutions and provide lessons for maintaining cooperation between villagers for collective action

(Ostrom, 1990; Rustagi et al., 2010). We consider collective action in forest management as an example. In Japan, most non-industrial private forest (NIPF) landowners have lost their motivation for timber production since timber prices began to decline. To maintain forestry activities in Japanese rural areas, joint forest management has received increasing attention as economies of scale reduce operating costs and one can expect efficient collective management (Mitani et al., 2013). In this paper, we explore how observed community characteristics explain resident NIPF landowners' participation in a joint forest management program.

Our survey reveals some interesting facts about the structure and characteristics of rural communities in Kumakogen town in Ehime, Japan. The median community size is 14 households, which is quite small and consistent with rural depopulation and also suggests potentially strong social interactions within the community members (Hare et al., 1965). 93 percent of households are members of local community organizations. 95 percent of organizations in the town have collective action/management agreements, and more than 30 percent of them have an enforcement instrument using a monetary penalty. Some institution characteristics, such as the frequency of community meetings and collective decision rules they employ, vary among communities.

We use actual contract data from Kuma Joint Thinning Program to test the influence of observed community characteristics on the likelihood of resident forest landowners' participation in collective management (Mitani et al., 2013). Our econometric analysis shows that the community-level characteristics have statistically significant association with the likelihood. Community size, the frequency of community meetings, and a lack of community forest have statistically significant positive effects on the likelihood. The result suggests that NIPF landowners who live in a community employing a majority approval rule for a leader's proposal are more likely to participate. We also confirm that the result is robust after controlling for other forest resource and landowners characteristics.

2. Study Site

Our study site, Kumakogen town, is located in the center of Ehime prefecture (33° 39'N, 132° 54'E), approximately 600 km southwest of Tokyo. The town is very mountainous and has 43,023 ha private forestland, which is 73.7 percent of the total land in the town. The resident

population of the town is 9,327 and 45.3 percent of them are older than 65 years of age. The town is constituted by four villages: Kuma, Omogo, Mikawa, and Yanadani. In total there are 219 local communities in the town: 119 in Kuma, 10 in Omogo, 59 in Mikawa, and 31 in Yanadani. Many communities are remote and isolated.

To explore how resident NIPF landowners' collective decision-making can be attributable to the observed community characteristics, we merged our survey data with actual contract data from the Kuma Joint Thinning Program (KJTP) for landowners' decision as a dependent variable of interest. Landowners' participation decision can be considered as a coordination problem between neighboring landowners because joint thinning operations, which provide benefits to participants, can be implemented only when the number of participants in the neighboring area or the total enrolled contiguous area reaches a certain threshold (Mitani et al., 2013).

3. Survey of Community Leaders

Design and Administration

We conducted a mail survey by approaching all 219 community leaders during July and August 2014, after early versions of the survey instrument were reviewed by local administrators. The number of responses was 115 with the overall response rate of 52.5 percent. A 3-page questionnaire consisted of three sections. The first section contained questions inquiring some statistics about his/her community and organization. We observed the number of households in a local community (*Comsize*), the percent of households holding community organization membership (*Memrate*), and the number of community meetings per year (*Freqmeet*).

The second part contained questions regarding collective action in his/her community. We asked whether his/her community has collective action or management agreements (*Collect*), whether his/her community has an enforcement instrument using a monetary fee (*Penalty*), and how much the fee is (*Penaltyfee*). We also asked whether his/her community has a community forest (*Comforest*). In addition, community leaders were asked what kind of collective decision rules they have used in their community organizations. We observed whether his/her community employs majority voting (*Majority*), majority approvals for a leader's proposal (*Approval)*, and consensus decision-making (*Consensus)*.

Following this, community leaders were asked questions related to households in their community, giving us the percentage of households living with younger generation members (*Youngrate*), the percentage of one-generation households (*Onegrate*), the percentage of households whose members are retired (*Retiredrate*), the percentage of immigrated (i.e. not native) households (*Immigrate*), and the percentage of households having city workers or commuters (*Commutrate*).

Results of Descriptive Statistics

The first sets of variables report characteristics of community organizations. Table 1 presents the descriptive statistics of community size (*Comsize*), membership rates (*Memrate*), and the frequency of community meetings (*Freqmeet*) by four villages. The median community size is 14 households in the town, which is small and consistent with rural depopulation whereas might suggest strong social interactions within the community members. The community organization membership rate is quite high. The number of community meetings per year ranges from 0 to 24 with high standard deviation.

The second sets of variables describe characteristics of collective action. Table 2 shows the descriptive statistics of collective agreements (*Collect*), an enforcement instrument (*Penalty*), the amount of penalty fee (*Penaltyfee*), and a community forest (*Comforest*). Almost all community organizations in the town have collective action or management agreements. More than 30 percent of them have an enforcement instrument using a monetary penalty.

Table 1. Descriptive Statistics on Community Organizations

Variable	Villages	Nobs	Mean	S.D.	Min	Max
Comsize	Total	109	17.7	13.0	1	86
	Kuma	56	19.2	11.0	3	50
	Omogo	5	32.0	32.1	5	86
	Mikawa	28	13.0	7.34	1	32
	Yanadani	20	16.4	15.0	4	69
Memrate	Total	109	0.93	0.10	0.5	1
	Kuma	56	0.93	0.10	0.57	1
	Omogo	5	0.84	0.17	0.57	1
	Mikawa	28	0.94	0.09	0.7	1
	Yanadani	20	0.94	0.13	0.5	1
Freqmeet	Total	109	6.50	5.20	0	24
	Kuma	57	5.21	4.41	0	20
	Omogo	4	14.5	3.79	12	20
	Mikawa	28	5.32	4.41	0	15
	Yanadani	20	10.2	5.64	3	24

Among four villages, Mikawa village has a higher share of communities having an enforcement mechanism. A community member has to pay the penalty fee when he/she is not able to cooperate for collective management. The median of the fee is 3,000 JPY while the mode is 5,000 JPY. Almost half of communities have community forest.

Table 3 reports the descriptive statistics of majority voting (*Majority*), majority approval for a leader's proposal (*Approval*), and consensus decision-making (*Consensus*). The percentage of communities using majority voting as a collective decision rule is highest while the percentage of them using majority approval for a leader's proposal is lowest. Local organizations employing an approval rule might have different community structures because

Table 2. Descriptive Statistics on Collective Action（1）

Variable	Villages	Nobs	Mean	S.D.	Min	Max
Collect	Total	110	0.95	0.23	0	1
	Kuma	57	0.95	0.23	0	1
	Omogo	5	1.00	0.00	1	1
	Mikawa	28	0.93	0.26	0	1
	Yanadani	20	0.95	0.22	0	1
Penalty	Total	109	0.33	0.47	0	1
	Kuma	56	0.29	0.46	0	1
	Omogo	5	0.20	0.45	0	1
	Mikawa	28	0.50	0.51	0	1
	Yanadani	20	0.25	0.44	0	1
Penaltyfee	Total	31	3569	2302	500	8800
	Kuma	15	3177	2155	900	7000
	Omogo	1	8800		8800	8800
	Mikawa	12	3333	1723	1000	5000
	Yanadani	3	4733	3669	500	7000
Comforest	Total	107	0.41	0.49	0	1
	Kuma	56	0.34	0.48	0	1
	Omogo	5	0.80	0.45	0	1
	Mikawa	27	0.56	0.51	0	1
	Yanadani	19	0.32	0.48	0	1

community leaders have initiative for collective decision.

The last sets of variables document characteristics of resident households. Table 4 shows the descriptive statistics of young household rates (*Youngrate*), one-generation household rates (*Onegrate*), retired household rates (*Retiredrate*), immigrated household rates (*Immigrate*), and city worker rates (*Commutrate*).

Table 3. Descriptive Statistics on Collective Action (2)

Variable	Villages	Nobs	Mean	S.D.	Min	Max
Majority	Total	108	0.40	0.49	0	1
	Kuma	56	0.43	0.50	0	1
	Omogo	5	0.20	0.45	0	1
	Mikawa	28	0.39	0.50	0	1
	Yanadani	19	0.37	0.50	0	1
Approval	Total	108	0.29	0.45	0	1
	Kuma	56	0.25	0.44	0	1
	Omogo	5	0.40	0.55	0	1
	Mikawa	28	0.25	0.44	0	1
	Yanadani	19	0.42	0.51	0	1
Consensus	Total	108	0.35	0.48	0	1
	Kuma	56	0.39	0.49	0	1
	Omogo	5	0.20	0.45	0	1
	Mikawa	28	0.36	0.49	0	1
	Yanadani	19	0.26	0.45	0	1

Table 4. Descriptive Statistics on Resident Household Characteristics

Variable	Villages	Nobs	Mean	S.D.	Min	Max
Youngrate	Total	106	0.09	0.15	0	1
	Kuma	53	0.13	0.15	0	0.75
	Omogo	5	0.05	0.06	0	0.15
	Mikawa	28	0.08	0.19	0	1
	Yanadani	20	0.02	0.03	0	0.09
Onegrate	Total	104	0.57	0.31	0	1
	Kuma	53	0.58	0.25	0	1
	Omogo	5	0.73	0.25	0.41	1
	Mikawa	26	0.60	0.35	0	1
	Yanadani	20	0.47	0.39	0	1
Retiredrate	Total	100	0.43	0.26	0	1
	Kuma	53	0.37	0.23	0	1
	Omogo	5	0.43	0.13	0.26	0.6
	Mikawa	23	0.49	0.30	0	1
	Yanadani	19	0.54	0.28	0	0.89
Immigrate	Total	105	0.07	0.17	0	1
	Kuma	53	0.10	0.19	0	1
	Omogo	5	0.03	0.04	0	0.08
	Mikawa	27	0.06	0.19	0	1
	Yanadani	20	0.03	0.06	0	0.17
Commutrate	Total	104	0.03	0.06	0	0.33
	Kuma	54	0.04	0.05	0	0.2
	Omogo	5	0.00	0.00	0	0
	Mikawa	25	0.04	0.08	0	0.33
	Yanadani	20	0.00	0.00	0	0

4. An Application

In order to understand the community-specific determinants of resident forest landowners' participation in a joint management program, we merge our community-specific survey data with actual contract data from the KJTP provided by the Kuma Forest Association (Mitani et al., 2013). The database contains almost 1,000 participants at the time of March 2011 with enrolled size in acres, enrolled year, and their forest size registered in a census.

Table 5 presents the variables used for our empirical test in this section with their descriptions, mean, and standard deviation. Our dependent variable (*Join*) collected from the census data is a dummy variable equal to 1 if a landowner has enrolled in the program until March 2011 and 0 otherwise. We estimate a logit regression with robust standard errors of the participation decision on the community characteristics variables in Model 1 and 2. To control for observable differences in landowners and allow us to focus on the community-specific determinants, we add a forest characteristics variable from the census data (Model 3) and four landowners' characteristics variables from forest owner survey data (Model 4) to the

Table 5. Summary of Variables

Variable	Descriptions	Mean	S. D.
Local Community Characteristics Variables (Local Community Survey Data)			
Comsize	the number of households in a local community	18.6	12.5
Memrate	a rate of households with community organization membership	0.92	0.12
Freqmeet	the number of community meetings per year	6.97	5.50
Collect	a community has joint activity/management agreements	0.96	0.20
Comforest	a community has community forest	0.44	0.20
Majority	a community employs majority voting as a collective decision rule	0.44	0.50
Approval	a community employs majority approval for a leader's proposal	0.29	0.45
Consensus	a community employs a consensus rule	0.36	0.48
Youngrate	a rate of households living with younger generation members	0.10	0.15
Onegrate	a rate of one generation households	0.56	0.36
Retiredrate	a rate of retired households	0.43	0.24
Immigrate	a rate of immigrated households	0.07	0.16
Commutrate	a rate of households having city workers/commuters	0.03	0.06
Census Joint-forest-management Variables (Census Data)			
Join	forest owner's participation decision in a JFM program	0.20	0.40
Forestsize	forest size registered in a census (hectare)	6.89	12.3
Survey Forest Owner Characteristics Variables (Forest Owner Survey Data)			
Border	recognizing the border of property (1: not at all; 5: perfectly)	4.22	1.07
Timsale	timber sales in the last 10 years	0.46	0.50
Male		0.88	0.32
Age		71.6	10.8

independent variables in our regressions (Suzuki et al., 2013).

Table 6 reports the estimation results of Model 1 and 2. These models contain only the community-specific variables observed by the survey. The results suggest that community characteristics can be determinants of resident coordination decision. The number of households in a community is positively associated with the likelihood of participation at the 1% risk level. The frequency of community meetings is also positively associated with the likelihood at the 5% risk level. A lack of community forest is positively associated with the likelihood at the 1% level. The result suggests that landowners who belong to the community that uses majority approval for a leader's proposal as a collective decision rule are more likely to participate at the 5% level.

Table 7 shows the estimation results of Model 3 and 4 in which the extra control variables are included. Estimated coefficients are consistent with the previous findings of NIPF landowners' behavior (Mitani and Lindhjem, 2015). The results confirm that our findings reported above are robust after controlling for other forest resource and landowners characteristics.

Table 6. Estimation Results (1)

	Model 1			Model 2		
	Coef.	S. E.	P	Coef.	S. E.	P
Comsize	0.048	0.012	0.000	0.041	0.009	0.000
Memrate	-0.111	1.356	0.935			
Freqmeet	0.059	0.027	0.028	0.045	0.021	0.033
Collect	-2.215	0.697	0.001	-0.294	0.740	0.692
Comforest	-1.039	0.303	0.001	-0.881	0.258	0.001
Majority	-0.263	0.369	0.476			
Approval	0.681	0.358	0.057	0.572	0.264	0.030
Consensus	0.054	0.362	0.881			
Youngrate	1.004	1.329	0.450			
Onegrate	0.148	0.500	0.767			
Retiredrate	0.331	0.699	0.636			
Immigrate	-2.987	1.600	0.062	1.528	1.281	0.233
Commutrate	7.035	2.454	0.004	4.532	1.995	0.023
Const.	-2.703	1.610	0.093	-3.984	1.091	0.000
LogLikelihood		-207.0			-233.2	
Pseudo R^2		0.112			0.081	
AIC		442.0			482.5	
Nobs		449			487	

Table 7．Estimation Results（2）

	Model 3			Model 4		
	Coef.	S. E.	P	Coef.	S. E.	P
Comsize	0.041	0.009	0.000	0.038	0.014	0.005
Freqmeet	0.043	0.022	0.044	0.062	0.030	0.039
Collect	-0.314	0.762	0.680	-0.714	1.206	0.554
Comforest	-0.885	0.263	0.001	-0.947	0.360	0.008
Approval	0.494	0.270	0.067	0.699	0.386	0.070
Immigrate	1.250	1.373	0.363	2.388	3.110	0.443
Commutrate	4.422	2.110	0.036	5.115	2.536	0.044
Forestsize	0.044	0.014	0.001	0.068	0.021	0.001
Border				-0.206	0.161	0.201
Timsale				-0.454	0.409	0.267
Male				-0.971	0.533	0.068
Age				-0.026	0.016	0.093
Const.	-4.223	1.127	0.000	-0.280	1.852	0.880
LogLikelihood		-227.0			-116.3	
Pseudo R^2		0.106			0.170	
AIC		471.9			258.6	
Nobs		487			237	

5. Concluding Remarks

Japanese rural villages suffer aging and shrinking population. The rural areas of Japan have a number of small and tight communities. Describing the structure of local communities in rural villages might reveal the role of community institutions and provide lessons for maintaining cooperation between neighbors for collective management (Ostrom, 1990). We implemented a survey of over 100 community leaders in rural mountainous villages in Kumakogen town to document local community structure and characteristics. For instance, we found that almost all communities in the town have collective action and/or management agreements and more than 30 percent of them have an enforcement instrument using a monetary penalty. Regarding collective decision rules in a community, the survey result showed that about 40 percent of communities in the town employ majority voting, about 35 percent of them employ consensus decision-making, and less than 30 percent of them use majority approvals for a leader's proposal.

As an application, we explored whether observed community characteristics explain resident NIPF landowners' participation behavior in a joint forest management program. The survey data were merged with actual contract data of a joint forest management program in the town for resident landowners' participation decision in collective management. Our

econometric analysis showed that some community-level characteristics have statistically significant association with the likelihood of participation. Community size, the frequency of community meetings, and a lack of community forest have statistically significant positive effects on the likelihood. The result suggests that NIPF landowners who live in a community employing majority approval for a leader's proposal are more likely to participate. We also confirm that the result is robust after controlling for other forest resource and landowners characteristics.

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